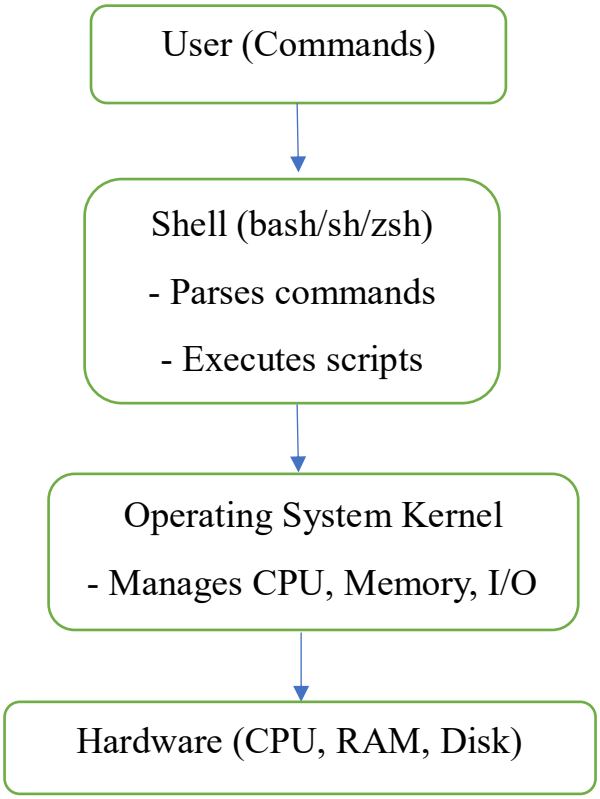
Shell Scripting

🔰Fundamentals:

1. What is a Shell?

- A shell is a program that takes commands from the user and gives them to the operating system to execute.
- Examples: bash (Bourne Again Shell), zsh, sh, ksh.
- Use: It's the interface between user and OS.



2. What is Shell Scripting?

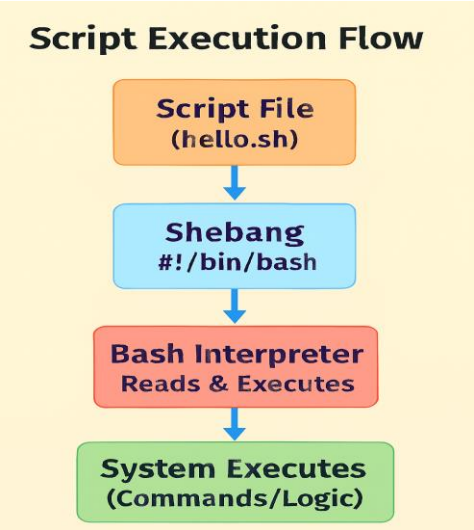
- Shell scripting is writing a sequence of commands in a file (script) that the shell can execute automatically.
- Use in DevOps: Automates repetitive tasks like deployments, monitoring, backups, and server setup.

3. Creating & Running a Script

Steps (works on Linux / WSL / Git Bash on Windows):

- Create a new file → nano hello.sh
- Add: #!/bin/bash
  echo "Hello, DevOps!"
- #!/bin/bash → Shebang → tells the system to use Bash shell.
- Save and exit.
- Make executable → chmod +x hello.sh
- Run → ./hello.sh

Output: Hello, DevOps!



4. Comments

- Text in a script ignored by the shell, used for documentation.
- Symbol: # (except in shebang).

Example:

```
#!/bin/bash
# This script prints hello
echo "Hello World"
```

5. Printing Output

- Displays text or values.
- Commands: echo, printf.

Example:

```
echo "Welcome to DevOps"
printf "User: %s\n" "Chinni"
```

Output:

```
Welcome to DevOps
User: Chinni
```

6. Variables

Variables store values (strings, numbers, paths).

Types:

- User-defined → created by you
- Environment → predefined (e.g., $HOME, $USER)

Example:

```
#!/bin/bash
name="Chinni"
echo "Hello $name"
echo "Your home directory is $HOME"
```

Output:

```
Hello Chinni
Your home directory is /home/chinni
```

7. User Input (read)

Allows users to provide input during script execution.

Example:

```
#!/bin/bash
echo "Enter your name: "
read username
echo "Welcome $username!"
```

Run → enter DevOps

Output:

```
Enter your name:
DevOps
Welcome DevOps!
```

8. Command Substitution

Runs a command and stores/prints its result.

Syntax: $(command) or `command`

Example:

```
#!/bin/bash
today=$(date)
echo "Today is $today"
```

Output:

```
Today is Fri Sep 12 21:10:15 IST 2025
```

9. Exit Status ($?)

- Every command returns an exit code → 0 (success), non-zero (error).

- Use: Check if a command worked before moving on.

Example:

```
#!/bin/bash
ls /notexist
echo "Exit status: $?"
```

Output:

```
ls: cannot access '/notexist': No such file or directory
Exit status: 2
```

10. Quotes in Shell

- Single quotes (' ') → literal (no variable expansion).
- Double quotes (" ") → expands variables.
- Backslash () → escapes characters.

Example:

```
#!/bin/bash
name="DevOps"
echo "Hello $name"   # variable expands
echo 'Hello $name'   # literal
echo "Path: \$HOME"  # escape
```

Output:

```
Hello DevOps
Hello $name
Path: $HOME
```

11. Arithmetic Operations

Perform calculations inside scripts.

Syntax: $((expression)) or expr.

Example:

```
#!/bin/bash
a=5
b=3
echo "Sum: $((a+b))"
echo "Product: $((a*b))"
```

Output:

```
Sum: 8
Product: 15
```

12. Script Arguments

Pass values when running a script.

Special variables:

- $0 = script name
- $1, $2 = first, second argument
- $# = number of arguments
- $@ = all arguments

Example (args.sh):

```
#!/bin/bash
echo "Script name: $0"
echo "First arg: $1"
echo "Second arg: $2"
echo "Number of args: $#"
```

Run: ./args.sh AWS DevOps

Output:

Script name: ./args.sh
First arg: AWS
Second arg: DevOps
Number of args: 2

Intermediate Topics

1. Conditional Statements (if, if-else, elif)

Used to make decisions in scripts based on conditions.

Syntax:

```
if [ condition ]; then
  commands
elif [ condition ]; then
  commands
else
  commands
fi
```

Example (ifelse.sh)

```
#!/bin/bash
```

```
echo "Enter a number: "
read num
if [ $num -gt 10 ]; then
   echo "Number is greater than 10"
elif [ $num -eq 10 ]; then
   echo "Number is equal to 10"
else
   echo "Number is less than 10"
fi
```

Output

```
Enter a number:
7
Number is less than 10
```

2. Loops

For Loop: Repeats commands for a list of items.

Example (for.sh):

```
#!/bin/bash
for i in 1 2 3 4 5
do
   echo "Number: $i"
done
```

Output:

```
Number: 1
Number: 2
Number: 3
Number: 4
```

Number: 5

While Loop: Runs while condition is true.

Example (while.sh):

```
#!/bin/bash
count=1
while [ $count -le 3 ]
do
    echo "Count: $count"
    ((count++))
done
```

Output:

```
Count: 1
Count: 2
Count: 3
```

Until Loop: Runs until condition becomes true.

Example (until.sh):

```
#!/bin/bash
count=1
until [ $count -gt 3 ]
do
    echo "Count: $count"
    ((count++))
done
```

Output:

```
Count: 1
Count: 2
Count: 3
```

3. Case Statement: Alternative to multiple if-else.

Syntax:

```
case $var in
  pattern1) commands ;;
  pattern2) commands ;;
  *) default ;;
esac
```

Example (case.sh)

```
#!/bin/bash
echo "Enter a choice: start/stop/restart"
read action
case $action in
   start) echo "Starting service..." ;;
   stop) echo "Stopping service..." ;;
   restart) echo "Restarting service..." ;;
   *) echo "Invalid choice" ;;
esac
```

Output

```
Enter a choice: start/stop/restart
restart
Restarting service...
```

4. Functions

A function is a reusable block of code inside a script.

Makes scripts modular & avoids repetition.

Example (function.sh)

```
#!/bin/bash
greet() {
    echo "Hello $1, welcome to DevOps scripting!"
}
greet "Chinni"
greet "Ravi"
```

Output

```
Hello Chinni, welcome to DevOps scripting!
Hello Ravi, welcome to DevOps scripting!
```

5. Arrays

An array stores multiple values in one variable.
Access: ${array[index]}, loop with "${array[@]}".

Example (array.sh)

```
#!/bin/bash
clouds=("AWS" "Azure" "GCP")
echo "First cloud: ${clouds[0]}"
for c in "${clouds[@]}"
do
    echo "Cloud: $c"
done
```

Output

```
First cloud: AWS
Cloud: AWS
Cloud: Azure
Cloud: GCP
```

6. String Operations

Strings can be checked, compared, and manipulated.

Example (string.sh):

```
#!/bin/bash
str="DevOps"
echo "Length: ${#str}"
echo "Substring (first 3 chars): ${str:0:3}"
if [ "$str" == "DevOps" ]; then
   echo "String matched"
fi
```

Output

```
Length: 6
Substring (first 3 chars): Dev
String matched
```

7. File Test Operators

Used to check properties of files and directories.

Operator	Meaning
-f file	True if file exists and is a regular file
-d dir	True if directory exists
-r file	True if readable
-w file	True if writable
-x file	True if executable

Example (filetest.sh)

```
#!/bin/bash
if [ -f "/etc/passwd" ]; then
   echo "File exists"
else
   echo "File not found"
fi
```

Output

File exists

8. Numeric & String Comparisons

Used in conditions inside scripts.

Operator	Meaning
-eq	equal
-ne	not equal
-lt	less than
-gt	greater than
==	strings equal

Operator	Meaning
!=	strings not equal

Example (compare.sh)

```
#!/bin/bash
a=5
b=10
if [ $a -lt $b ]; then
   echo "$a is less than $b"
fi
```

Output: 5 is less than 10

9. Input/Output Redirection

Redirects command output/input.

Symbol	Meaning
>	overwrite output to file
>>	append output to file
<	take input from file
2>	redirect errors
&>	redirect both stdout & stderr

Example (redirect.sh)

```
#!/bin/bash
echo "Hello World" > output.txt
```

cat output.txt

Output: Hello World

10. Pipes

A pipe (|) passes output of one command as input to another.

Example (pipe.sh):

```
#!/bin/bash
ps aux | grep bash
```

Output:
(Shows all running processes with "bash" in them)

11. Debugging

Run a script in debug mode with bash -x script.sh

Shows each command before execution.

Example: bash -x hello.sh

Output (with debug trace):

+ echo 'Hello, DevOps!'

Hello, DevOps!

12. Break

break is used inside loops (for, while, until) to terminate the loop immediately, regardless of the condition.

After break, the control jumps out of the loop and continues with the next command after the loop.

Example with break:

```
#!/bin/bash
# Break Example
for num in 1 2 3 4 5
do
  if [ $num -eq 3 ]; then
    echo "Found 3! Exiting loop..."
    break
  fi
  echo "Number: $num"
done
echo "Loop ended."
```

Output:

```
Number: 1
Number: 2
Found 3! Exiting loop...
Loop ended.
```

13. Continue

continue is used inside loops to skip the rest of the current iteration and move to the next iteration of the loop.

The loop itself is not terminated.

Example with continue:

```
#!/bin/bash
# Continue Example
for num in 1 2 3 4 5
do
  if [ $num -eq 3 ]; then
    echo "Skipping number 3..."
```

```
    continue
  fi
  echo "Number: $num"
done
echo "Loop completed."
```

Output:

```
Number: 1
Number: 2
Skipping number 3...
Number: 4
Number: 5
Loop completed.
```

Use case: Skip processing unwanted data but continue the loop.

Real-world DevOps Example:

Script: Stop at first failed server check

```
#!/bin/bash
servers=("google.com" "invalidsite.com" "yahoo.com")
for server in "${servers[@]}"
do
  ping -c 1 $server > /dev/null 2>&1
  if [ $? -ne 0 ]; then
    echo "Server $server is down! Stopping checks."
    break
  fi
```

```
  echo "Server $server is UP."
done
```

Output:

Server google.com is UP.
Server invalidsite.com is down! Stopping checks.

🚀 Advanced Shell Scripting Topics

1. Error Handling (set -e, trap, ||, &&)

Error handling ensures that your script **doesn't silently fail** when a command breaks.

- set -e: Exit immediately if a command fails.
- trap: Run specific commands when a signal/error occurs.
- ||: Run next command only if the previous fails.
- &&: Run next command only if the previous succeeds.

Example

```
#!/bin/bash
set -e   # Exit on error
echo "Starting script..."
ls /tmp/testfile || echo "File not found!"
echo "This line won’t run if an error occurs."
```

Output

```
Starting script...
ls: cannot access '/tmp/testfile': No such file or directory
File not found!
```

2. Logging (redirecting to log files, timestamps)

Definition

Logging records script activities for debugging & auditing.

> overwrite log

>> append log

Use date for timestamps

Example

```
#!/bin/bash
logfile="script.log"
echo "$(date): Script started" >> $logfile
```

```
echo "Running a task..." >> $logfile
```

Output in script.log:

```
Fri Sep 12 20:00:00 IST 2025: Script started
Running a task...
```

3. File Handling (cat, grep, awk, sed)

Scripts often process files (create, read, update, delete).

- cat: display file
- grep: search text
- awk: column/row processing
- sed: text replacement

Example

```
#!/bin/bash
echo "user1,user2,user3" > users.txt
cat users.txt
grep "user1" users.txt
awk -F',' '{print $2}' users.txt
sed 's/user2/admin/' users.txt
```

Output

```
user1,user2,user3
user1
user2
user1,admin,user3
```

4. Signals & Traps

trap lets you handle **signals** like SIGINT (Ctrl+C).

Example

```
#!/bin/bash
trap "echo 'Script interrupted! Cleaning up...'; exit" SIGINT
echo "Running... Press Ctrl+C to stop."
while true
do
  sleep 2
done
```

Output

Running... Press Ctrl+C to stop.

^C Script interrupted! Cleaning up...

5. Regular Expressions

Regex helps **match patterns** in text.

- grep -E "pattern" → extended regex
- [[string =~ regex]] → bash regex

Example

```
#!/bin/bash
text="devops2025"
if [[ $text =~ [a-z]+[0-9]{4} ]]; then
  echo "Matched: $text"
fi
```

Output: Matched: devops2025

6. Scheduling with Cron Jobs

Cron runs scripts at scheduled times.

Edit cron: crontab -e

Syntax: * * * * * command

min hour day month weekday

Example (run every 5 minutes)

*/5 * * * * /home/user/backup.sh >> backup.log 2>&1

7. Process Management

Manage processes inside scripts.

- & run in background
- ps list processes
- kill stop process

Example

```
#!/bin/bash
sleep 100 &
pid=$!
echo "Started process with PID $pid"
kill $pid
```

Output: Started process with PID 1234

8. Working with JSON/YAML (jq, yq)

Use tools to parse structured data in scripts.

Example (JSON with jq)

echo '{"name":"devops","year":2025}' | jq '.name'

Output: "devops"

9. Command-line Arguments Parsing (getopts)

getopts helps handle **flags/options** like -u username -p password.

Example

```
#!/bin/bash
while getopts u:p: flag
do
  case "${flag}" in
    u) user=${OPTARG};;
    p) pass=${OPTARG};;
  esac
done
echo "User: $user, Password: $pass"
```

Run: ./script.sh -u admin -p 1234

Output: User: admin, Password: 1234

10. Automation Scripts

Examples

- Backup: tar -czf backup.tar.gz /home/user/
- Monitoring: df -h | awk '$5 > 80 {print "Disk usage alert!"}'
- Deployment (copy files): scp app.tar.gz server:/opt/apps/

11. Shell Script Optimization & Best Practices

- Use set -euo pipefail (strict mode)
- Modularize with functions

- Log everything
- Avoid hardcoding paths (use variables)
- Test with shellcheck

12. Integration in DevOps Pipelines

- **Jenkins** → use shell scripts in pipeline stages
- **GitHub Actions** → define run: ./deploy.sh
- **Docker** → entrypoint scripts for containers
- **Kubernetes** → init scripts for pods